Space Weather Technical Forecast

Issued on Tuesday, 30 April 2024 at 12:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: A chance of further M-flares and slight chance of X-flares through the period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity continues at Moderate levels with an M1.6 flare peaking at 30/0114 UTC, originating from AR3654. There are currently five sunspot regions on the visible disc. AR3654 in the western disc continues to dominate the flare risk. This region continues to show further evolution in its intermediate and trailing portions in recent imagery, also with an apparent increase in magnetic flux. Remaining sunspot regions are all relatively small and simple.
Whilst there are thought to have been no Earth directed CMEs in the last 24 hours, modelling is still ongoing of a CME which emerged to the northwest on 29 April, which may have erupted from near centre disc.

Solar Wind / Geomagnetic Activity: Solar winds observed by ACE at L1 have been on a declining trend as the recent High Speed Stream (HSS) eases, with a weak CME arrival at 30/1135 UTC. Wind speeds have eased from around 470 km/s to near 380km/s, jumping to 420 km/s after the CME arrived. Density was mostly below average, becoming average recently. The Interplanetary Magnetic Field was weak, reaching 6nT after the CME arrival. The north-south component, Bz, also varied weakly between +4/-3nT. Phi angle has been variable. Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) observed at GOES18 was at background levels. High energy electron flux (greater than 2MeV) observed at GOES16 was at background to moderate levels. The associated 24-hour fluence was well below the Active threshold, with a very slight rising trend. Observed fluence at 30/0001UTC was 6.22e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a chance of M-flares and a slight chance of X-flares though the period, starting to decline later on Day 4 (03 May), this mainly in association with AR3654.

Solar Wind / Geomagnetic Activity: There is currently one weak CME featuring in the forecast, which appears to have just arrived at L1. Solar winds were at background levels after the recent weak High Speed Stream (HSS) influence. During Day 2 (01 May) CH31/- is likely to bring elevated wind speeds briefly. This is followed by CH32/+, which could bring another increase in wind speeds back to elevated levels later on Day 4 (03 May), or perhaps after the end of this period.
Geomagnetic activity is expected to be largely Quiet to Unsettled, but with a slight chance of Active to G1/Minor Storm intervals due to CME or HSS influence through much of this period.

Energetic Particles / Solar Radiation: High energy proton flux is most likely to remain at background levels through this period. There is a slight chance for an S1 or greater event, with AR3654 posing the main risk as it continues to rotate westwards.
High energy electron flux likely remaining at background to moderate levels, with the associated fluence expected to remain below the Active (1e8 integrated pfu) threshold throughout.

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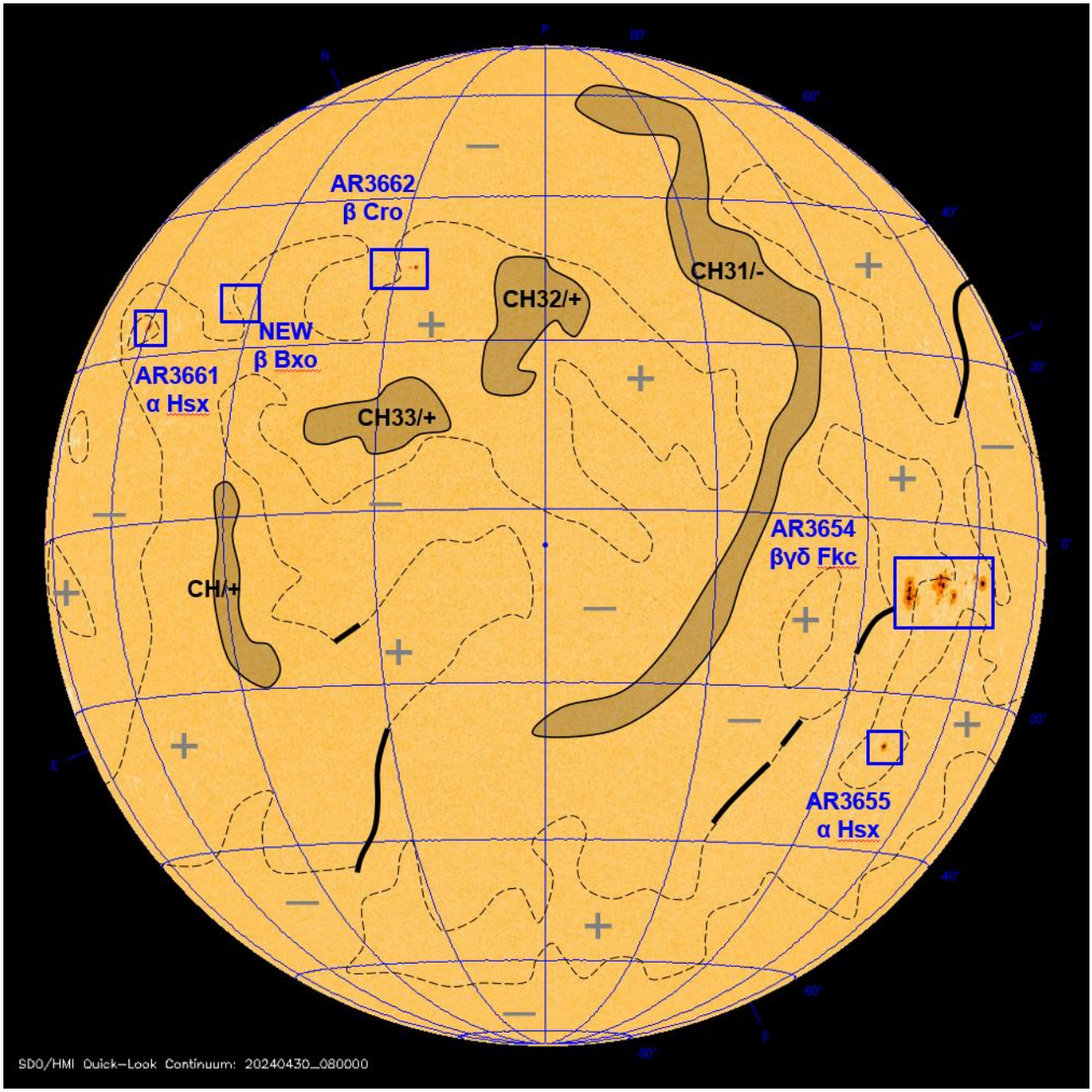
Figure 1. Solar Analysis Valid 30/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There is currently one CME featuring in the forecast, this started around 26/1830 UTC and emerged from an area of plage in the southeast of the disc, likely associated with a filament eruption. This appears to have just arrived at L1.

Solar winds were at background levels after the recent weak High Speed Stream (HSS) influence. During Day 2 (01 May) a potential connection comes from the increasingly narrow trans-equatorial coronal hole CH31/-, likely bringing elevated wind speeds briefly. This is followed by CH32/+ in the northern hemisphere, which could bring another increase in wind speeds back to elevated levels later on Day 4 (03 May), or perhaps after the end of this period. CH31 being negative, however, is the more likely of the two to give some geomagnetic response.

Geomagnetic activity is expected to be largely Quiet to Unsettled, but with a slight chance of Active to G1/Minor Storm intervals due to CME or HSS influence through much of this period.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	15	5	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

No further Earth directed CMEs are currently expected, although one that emerged yesterday is still being assessed for any Earth directed component.

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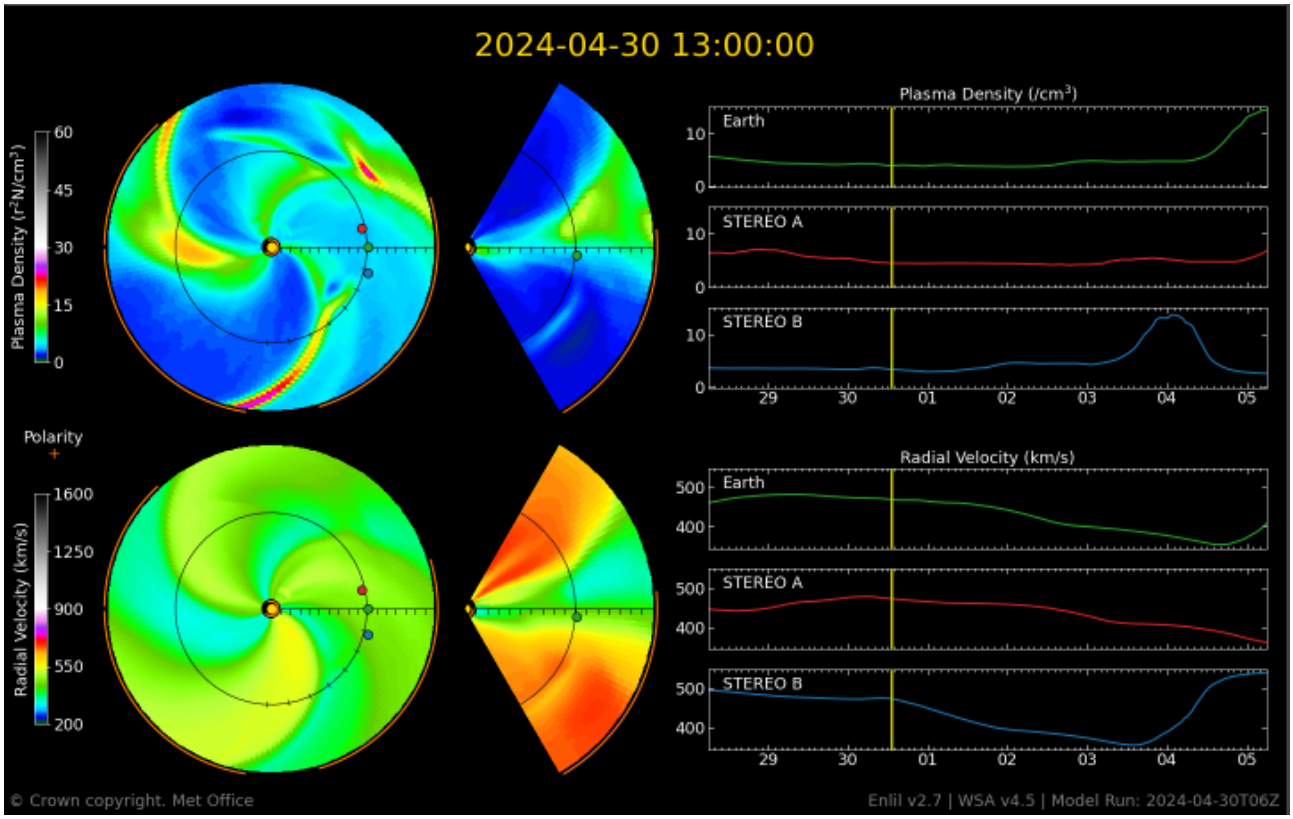
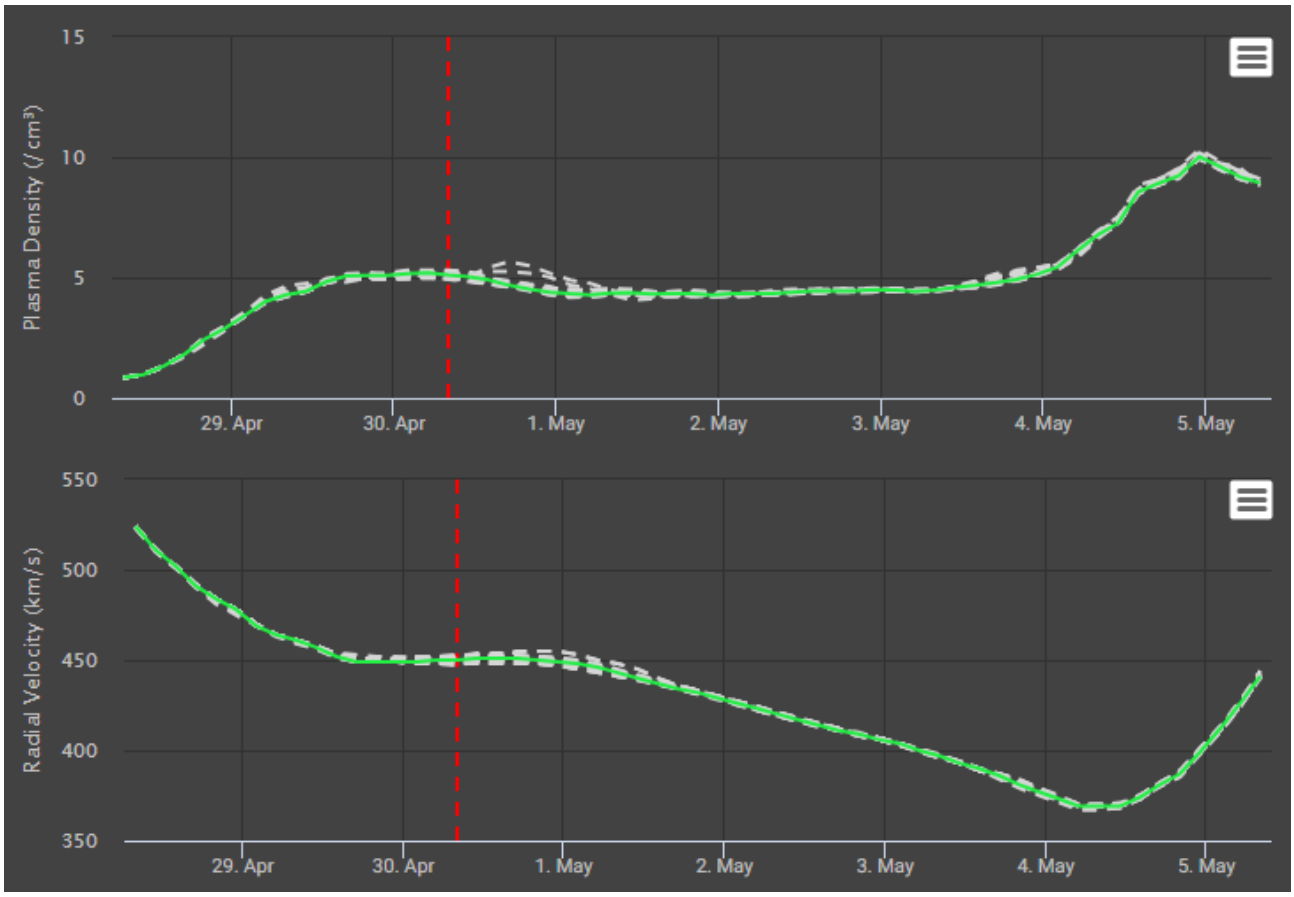
Figure 2: MOSWOC Enlil and ensemble, showing the recently arrived CME mostly passing behind Earth, suggesting impacts are likely to be limited.





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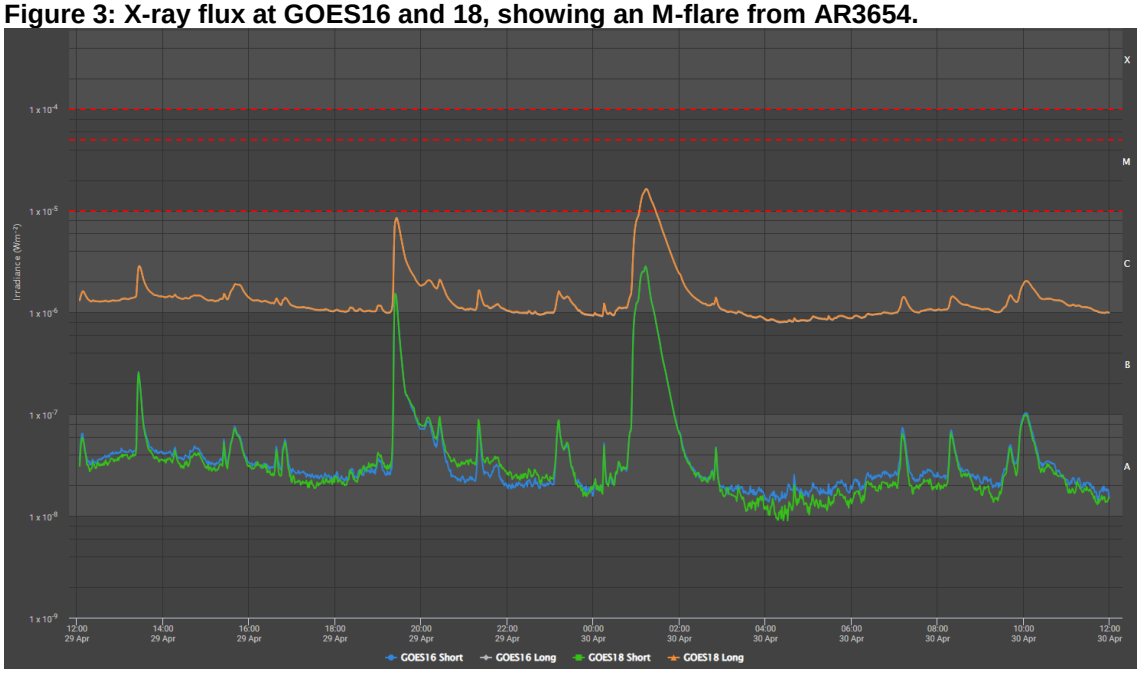
Radio Blackouts - X-Ray Flares:
Solar activity continues at Moderate levels with an M1.6 flare peaking at 30/0114 UTC, originating from AR3654.

There are currently five sunspot regions on the visible disc. AR3654 in the western disc continues to dominate the flare risk. This region continues to show further evolution in its intermediate and trailing portions in recent imagery, also with an apparent increase in magnetic flux. Whilst this region has so far only been responsible for low level M-flares, there is perhaps a slightly increased risk compared to previously of an X-flare from this region. Remaining sunspot regions are all relatively small and simple.

No significant returning regions are expected through the period with limited signals in far-side helioseismographs. AR3654 is due to rotate off the visible disk very early on Day 4 (03 May), with the risk starting to reduce later on Day 4. Overall, a chance of further M-flares is maintained through the period, with a slight chance of isolated X-flares, this mainly from AR3654.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	50	50	50	50
Very Active	R3 to R5 X Class	No	15	15	15	15

Figure 3: X-ray flux at GOES16 and 18, showing an M-flare from AR3654.



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Solar Radiation Storms - (High Energy Protons):
High energy proton flux (greater than 10MeV) observed at GOES18 has been at background levels, and is most likely to remain that way through this period. There is a slight chance for an S1 or greater event however, should there be any large flares from AR3654 as it continues to rotate westwards.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	15	15	15	15
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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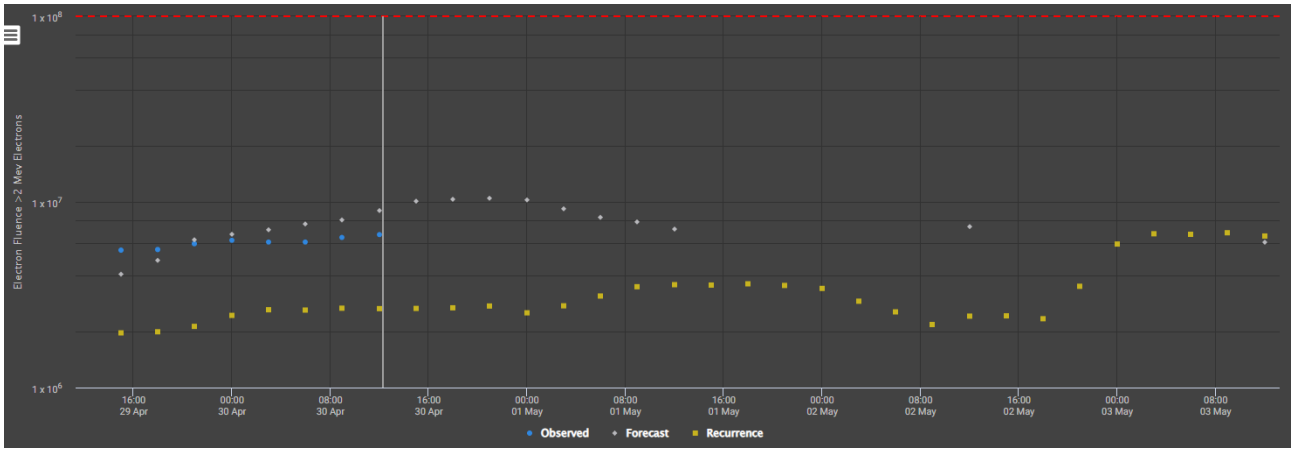
High Energy Electrons Event (≥ 2MeV):
High energy electron flux has been mostly at background levels, just touching moderate at the diurnal peak. The recent HSS influence was weak enough that no significant increase in electron flux is expected from this. During Day 2 (01 May) CH31/- may become geoeffective, likely bringing elevated wind speeds, although this will most probably only be for a brief period. As such, no significant increase in electron flux is expected from this feature, although counts may reach moderate levels at the diurnal maxima. A further HSS from CH32/+ is possible near the end of this period, which could reduce any flux increase once again.

Overall, the 24 hour integrated electron fluence is most likely to remain below the Active (1e8 integrated pfu) threshold, perhaps with a very slight rising trend in the latter half of the period. MOSWOC REFM is currently forecasting fluence to remain well below the Active level, and appears good guidance at present.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM showing fluence well below Active through this period, which seems like good guidance.



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